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Indian Standard

SPECIFICATION FOR HOT AIR FAN

(First Revision)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 7 *September 1982*

Indian Standard
SPECIFICATION FOR HOT AIR FAN
(First Revision)

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(*Continued on page* 2)

*Shri V. A. Krishnamurthy was the Chairman for the meeting in which this standard finalized.

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AMENDMENT N0. 1 JANUARY 1994
TO
IS 4283 : 1981 SPECIFICATION FOR HOT AIR FAN

(First Revision)

(*Page* 23, *clause* A-3-1) — Add the following after this clause:

'These measurements shall be made without the heater on, so that anemometer measures air velocity.'

(*Page* 24, *clause* A-4) — Substitute the following for the existing matter:

'**A-1** Hot air temperature will be measured, may be in the same direction, independently by means of thermometer, under temperature stabilized within the duct. The thermometer shall be placed at a distance x + 50 mm from the hot air fan, in each position. The average of all readings is taken as the temperature of the hot air.'

(ETD 05)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 JUNE 1995
TO
IS 4283 : 1981 SPECIFICATION FOR HOT AIR FAN

(First Revision)

(*Page* 14, *clause* 6.2) — Substitute the following for the existing clause:

'**6.2** The volume and temperature rise of the hot air at the points defined in Appendix A shall be measured and the average value shall not be less than that the minimum value declared by the manufacturer.'

[*Page* 14, *clause* 7.1(g)] — Substitute the following for the existing:

g) Minimum air volume, and'

[*Page* 14, *clause* 7.3(h)] — Substitute the following for the existing:

'h) Temperature rise of the hot air when tested in accordance with 8.4.1.'

(*Amendment No.* 1, *January* 1994, *last para*) — Substitute clause No. 'A-4' *for* 'A-1'

(ETD 5)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 SEPTEMBER 2007
TO
IS 4283 : 1981 SPECIFICATION FOR HOT AIR FAN

(First Revision)

[*Page* 14, *clause* **7.1**(f)] — Insert the following after **7.1**(f) and renumber **7.1**(g) and **7.1**(h):

'g) Rated air velocity;
h) Rated air temperature;'

(ET 32)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR HOT AIR FAN

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 7 September 1981, after the draft finalized by the Electric Fans Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was originally published in 1967. This revision has been undertaken to:

a) Incorporate additional safety requirements and methods of test regarding safety aspects, such as protection against electric shock, moisture resistance, creepage distances and clearances, and align other safety requirements with IS : 302-1979* as far as applicable.

b) Include air delivery test (including temperature) for evaluating the performance.

c) Include the experience gained in the field since publication of the earlier version.

0.3 IS : 302-1979* to which references have been made in this standard regarding some safety aspects is a necessary adjunct to this standard. Should, however, any deviations exist between IS : 302-1979* and those of this standard, the provisions of the latter shall apply.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard specifies the requirements and methods of test for hot air fans designed for connection to supply at voltages not exceeding 250 V ac single-phase or dc.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Hot Air Fan — An electrical appliance incorporating a fan and heating elements, the fan blowing air through the heating elements.

2.2 Rating — A statement of the operating characteristics assigned to the hot air fan by the manufacturer when tested in accordance with **8**.

2.3 Rated Voltage — The voltage assigned to the fan by the manufacturer and marked on it.

2.4 Rated Voltage Range — The voltage range assigned to the hot air fan by the manufacturer expressed by its upper and lower limits and marked on it.

2.5 Rated Frequency — In case of an ac operated appliance, the frequency assigned to the fan by the manufacturer and marked on it.

2.6 Rated Frequeny Range — The limits of the frequency assigned to the hot air fan by the manufacturer and marked on it.

2.7 Rated Input — The input under conditions of normal load and at normal operating temperature assigned by the manufacturer.

2.8 Power Supply Cord — A flexible cable or cord, for connection to supply, fixed to or assembled with the appliance according to one of the following methods:

Type X attachment which denotes a method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a flexible cable or cord not requiring any special preparation;

Type M attachment which denotes a method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a special cable or cord with, for example, a moulded-on cord guard or crimped terminations;

Type Y attachment which denotes a method of attachment such that the flexible cable or cord can be replaced only with the aid of special purpose tools normally available only to the manufacturer or his agent;

NOTE — *Type Y attachment* may be used either with common flexible cables or cords or with special cables or cords.

2.9 Basic Insulation — Insulation applied to live parts to provide basic protection against electric shock.

NOTE — Basic insulation does not necessarily include insulation used exclusively for functional purposes.

2.10 Supplementary Insulation — An independent insulation applied in addition to the basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation.

2.11 Double Insulation — Insulation comprising both basic insulation and supplementary insulation.

2.12 Reinforced Insulation — A single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

NOTE — The term ' insulation system ' does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

2.13 Visibly Glowing Heating Element — A heating element which, when the appliance is assembled ready for use, is either partly or completely visible from the outside of the appliance, and the temperature of which is at least 650°C when the appliance has been operated under conditions of normal use until steady state conditions are established, the supply voltage being such that the input is equal to the minimum rated input.

2.14 Normal Load — The load to be applied in such a way that the stress imposed corresponds to that occurring under normal condition of use, heating elements being operated as in normal use.

2.15 Class I Type Hot Air Fan and Regulator — Denotes the one in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that accessible conductive parts are connected to the protective earthing conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

NOTE 1 — Class I type may have parts with double insulation or reinforced insulation, or parts operating at safety extra — low voltage.

NOTE 2 — For hot air fans and regulators intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

2.16 Class II Type Hot Air Fan and Regulator — Denotes the one in which protection against electric shock does not rely on basic insulation only, but in which additional safety precaution, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

Such hot air fans and regulators may be one of the following types:

a) Having a durable and substantially continuous enclosure of insulating material which envelops all metal parts, with the exception of small parts, such as name-plates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinfored insulation; such an appliance is called an insulation — encased Class II appliance.

b) Having a substantially continuous metal enclosure in which double insulation is used throughout, except for those parts where reinforced insulation is used because the application of double insulation is manifestly impracticable; such an appliance is called a metal — encased Class II type.

c) One which is a combination of types (a) and (b).

NOTE 1 — The enclosure of an all-insulated Class II type may form a part or the whole of the supplementary insulation or of the reinforced insulation.

NOTE 2 — If fans and regulators with double insulation and/or reinforced insulation throughout has an earthing terminal or earthing contact, it is considered to be of Class I.

NOTE 3 — Class II type may have parts operating at safety extra-low voltage.

2.17 Portable Appliance — Either an appliance which is moved while in operation or an appliance which can easily be moved from one place to another while connected to supply.

2.18 Stationary Appliance — Either a fixed appliance or an appliance having a mass exceeding 18 kg and not provided with a carrying handle.

2.19 Fixed Appliance — An appliance which is fastened to a support or otherwise secured in a specific situation.

2.20 Thermostat — A temperature sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, keeps the temperature of an appliance or parts of it, between certain limits by automatically opening and closing a circuit.

2.21 Thermal Cut-Out — A device which, during abnormal operation, limits the temperature of an appliance or of parts of it, by automatically opening the circuit or by reducing the current and which is so constructed that its settting cannot be altered by the user.

2.22 Clearance — The shortest distance between two conductive parts or between a conductive part and bounding surface of an appliance, measured through air.

2.23 Creepage Distance — The shortest path between two conductive parts, or between a conductive part and bounding surface of an appliance, measured along the surface of the insulating material.

2.24 All-pole Disconnection — Disconnection of both supply conductors by a single switching action for single phase ac appliances and dc appliances; or for appliances to be connected to more than two supply conductors, disconnection of all supply conductors except the earthed (grounded) conductor by a single switching action.

NOTE — Protective earth conductor is not considered to be a supply conductor.

2.25 Accessible Part or Accessible Surface — Is a part or surface which can be touched by means of standard test probes.

2.26 Type Tests — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove general qualities and design of a given type of fan.

2.27 Routine Tests — Tests carried out on each fan to check the essential requirements which are likely to vary during production.

2.28 Acceptance Tests — Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

2.28.1 *Lot* — All fans of the same type, grade, category and rating, manufactured by the same factory during the same period, using the same process and materials.

3. RATING

3.1 Rated Voltage — The rated voltage of the hot air fan shall be 240 V. However, 230 V is also permitted for the time being.

3.2 Rated Input — The rating in watts for hot air fans should preferably be chosen from the following values:

500, 750, 1 000, 1 250, 1 500, 2 000 and 2 500.

3.3 Rated Frequency — The rated frequency shall be the standard frequency of 50 Hz.

NOTE — Nevertheless, fans made for other voltage and frequencies shall be considered to comply with this specification provided they do so in all other relevant respects.

4. DESIGN AND GENERAL CONSTRUCTION

4.1 General — The fan shall be so designed and constructed that in normal use and under fault conditions, it ensures:

a) personal safety against electric shock,

b) personal safety against the effects of excessive temperature, and

c) safety against fire.

4.2 Enclosure — The enclosure of the hot air fan shall be reasonably rigid and shall have no openings giving access to live parts other than openings necessary for use and working of the fan. Where such openings are necessary, sufficient protection against accidental contact with live parts and functionally insulated parts shall be provided. Lacquering or enamelling is not considered as adequate protection or insulation for this purpose.

4.3 Guard — The guard shall be of robust construction and securely attached to the fan. If the guard is so designed or attached that it, or any portion of it, may be removed, lifted or swung to one side then the method of attachment shall be such that, when replaced, the guard, or any detachable or movable portion of it may not be accidentally dislodged from its working position during normal use. When the guards are in two pieces, positive locking arrangement to keep the two pieces together shall be made.

4.4 Switches

4.4.1 Fan intended for connection direct to the main without flexible cords shall be fitted with at least one double pole switch, connected so as to isolate all live parts liable to be touched, when replacing an interchangeable element or lamp.

4.4.2 If single pole switches are provided they shall be meant to control the live conductor of the circuit.

4.5 Handles, Operating Levers, Knobs, Etc

4.5.1 Handles, operating levers, knobs and the like, the shafts of which may become live in the case of an insulation fault, shall be of insulating material or shall be adequately covered by insulating material.

4.5.2 All switches and controls on wall-mounted hot air fans shall be operated by a non-conducting cord or rod sufficiently long to render inadvertent contact with the live parts of room heater unlikely. It shall be possible to replace the cord or rod without removing parts giving access to live parts, or removing the fan from its mounting.

4.5.3 Handles, knobs, grips and the like shall not work loose in normal use. If these are used to indicate the operational position of the switches or the like, the method of fixing shall be such as to obviate them being fixed in an incorrect position.

4.6 Internal Wiring

4.6.1 Internal wiring and heating wires shall be either so rigid and fixed or insulated that creepage distances and clearances do not decrease in normal use beyond the minimum specified in **5.6**.

4.6.2 The electrical connections between the heating elements and switches or between the elements and external connecting leads shall be effected without solder, by suitable connectors or teminals which shall be so placed that the temperature of any part of switch or terminals or conductor to which the insulated cables are connected do not exceed the safe permisible temperatue for the respective parts.

4.6.3 Beads and other ceramic insulators on live wires shall be so fixed or supported that they do not change their positions and they shall not rest on sharp edges.

5. GENERAL AND SAFETY REQUIREMENTS

5.1 Protection Against Electric Shock — Hot air fans shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts and for Class II type, with metal parts separated from live parts by functional insulation only. This requirement is applicable for all positions in normal use.

5.2 Electrical Insulation Under Normal Operating Condition

5.2.1 The electrical insulation of hot air fans at operating temperature shall be adequate (*see* **5.2.2** and **5.2.3**) and the leakage current in normal use (*see* **5.2.4**) shall not be excessive.

5.2.2 When measured according to the method specified in **8.4.8** the insulation resistance shall not be less than 2 MΩ.

5.2.3 The insulation is subjected for one minute to a voltage of substantial sine wave-form having a frequency of 50 Hz as given in **8.4.7**.

5.2.4 When measured according to the method given in **8.4.6**, the leakage current shall not exceed the following limits:

i) For Class I type hot air fans the leakage current which may flow from the live parts to the accessible parts and metal foil on external insulating material connected together shall not exceed 300 μA (peak), that is, 210 μA (rms).

ii) For Class II type hot air fans the leakage current from live part to the inner non-current carrying metal part shall not exceed 300 μA (peak) whereas the leakage current from live parts to the metal foil wrapping (for all insulated hot air fans) or the external metal and metal foil wrapping connected together (for double insulated hot air fans) shall not exceed 60 μA (peak), that is, 42·5 μA(rms).

5.3 Temperature-Rise

5.3.1 The hot air fan shall be tested at any cooling air temperature not exceeding 40°C but whatever may be the value of this temperature, the permissible temperature-rise shall not exceed the values given in Table 1.

TABLE 1 TEMPERATURE-RISE LIMITS

PARTS	TEMPERATURE RISE, °C
Winding of fan motor, with:	
Class A insulation	60
Class E insulation	75
Class B insulation	80
Wooden supports, walls, ceiling and floor of the test corner and wooden cabinets	50
Pins of appliance inlets	80
Terminals of fixed fans for supply connection	45
Handles, grips and the like which, in normal use, are continuously held in the hand and which are made of:	
Metal	15
Porcelain or vitreous material	25
Moulded material, rubber or wood	35
Handles, knobs, grips and the like, which in normal use, are held for short periods only (for example, switches) and which are made of:	
Metal	20
Porcelain or vitreous material	30
Moulded material, rubber or wood	45
Rubber insulation	35
PVC insulation	35

5.4 Mechanical Strength

5.4.1 Hot air fans shall have adequate mechanical strength and be so constructed as to withstand such rough handling as may be expected in normal use (*see* **8.4.11**).

5.5 Moisture Resistance

5.5.1 Hot air fans shall be proof against humid conditions which may occur in normal use (*see* **8.4.10**).

5.6 Creepage Distances and Clearances

5.6.1 Creepage distances and clearances shall be according to the relevant provisions given in **29** of IS : 302-1979*.

5.7 Stability

5.7.1 Hot air fans, other than those of fixed type, intended to be used on surface such as floor or a table shall have adequate stability.

5.8 Thermostats and Thermal Cut-Outs

5.8.1 Hot air fan shall be provided with a thermostat or a thermal cut-out. Thermostats shall have adequate making and breaking capacity. Thermal cut-outs shall operate reliably. Thermostats and thermal cut-outs shall be so constructed that their setting is not changed appreciably due to heating, vibration, etc, occurring during normal use. The fans shall be so constructed that accidental changing of the setting of the thermostat and thermal cut-out is unlikely to occur.

5.9 Supply Connection

5.9.1 Fan shall be provided with either a non-detachable flexible cord or an appliance-inlet.

5.9.2 Appliance-inlet shall be so placed as to allow easy insertion of connectors.

5.9.3 *Service Cord* — The service cord when provided shall be three core flexible cord (one of the cores being the earthing lead), of sufficient current-carrying capacity with reference to the rated loading of the fan and complying with IS : 434 (Part I)-1964† or IS : 694-1977‡. The length of the service cord shall be not less than 2·0 m.

5.9.3.1 The cross-sectional areas of the conductors of flexible cords or cables shall be such that the current ratings do not exceed the values given in Table 2.

5.9.3.2 Inlet openings for flexible cords shall be rounded and smooth.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

†Specification for rubber-insulated cables : PartI With copper conductors (*revised*).

‡PVC insulated cables for working voltages up to and including 1 100 volts (*second revision*).

TABLE 2 CURRENT RATING

(*Clause* 5.9.3.1)

CURRENT RATING	NOMINAL CROSS-SECTIONAL AREA OF CONDUCTOR
A	mm^2
2	0·5
5	0·75
10	1·0
15	1·5

5.10 Cord Grip

5.10.1 Fans with non-detachable flexible cords shall be provided with a cord grip such that the ends of the conductors connected to the terminals are relieved from strain, including twisting, and the outer surface of the cord is not damaged. Make-shift methods, such as tying the cord into a knot or tying the end with string, shall not be used.

5.10.2 The surfaces by which the cord is gripped and any parts with which the cord might come in contact shall be of insulating material or covered with insulating material. The cord grip shall be adaptable and suitable for the types of cord specified by the manufacturer of the fan.

5.11 Terminals

5.11.1 The materials, design and proportions of all terminals shall be such that connections made thereto do not slacken or overheat under normal conditions of use. Terminal shall be rust-proof.

5.11.2 In pillar type terminals the screw shall be of sufficient length to extend to the far side of the terminal hole and shall be of a diameter approximately equal to that of the hole. The ends of the screws shall be rounded or chamfered to prevent undue damage to the conductors; the inside of the hole shall be smooth and continuous.

5.11.3 A self-tapping screw shall not be used as a terminal screw for conductors.

5.12 Screws

5.12.1 Screws and rivets which serve electrical as well as mechanical connections, shall be locked against loosening. Spring washers may provide satisfactory locking. For rivets a non-circular shank or an appropriate notch may be sufficient for locking. Sealing compound or the like provides satisfactory locking only for screw connections not subject to torsion during normal use.

5.12.2 Self-tapping screws may be used for connections ensuring earth continuity provided such screws are duplicated and are not required to be removed during the use or servicing of fan.

5.13 Earthing

5.13.1 Accessible metal parts of Class I type hot air fans, which may become live in the event of an insulation fault, shall be permanently and reliably connected to an earthing terminal or termination within the appliance, or to the earthing contact of the appliance inlet. Earthing terminals and earthing contacts shall not be electrically connected to the neutral terminal, if any.

Class II hot air fans shall have no provision for earthing.

5.14 Finish

5.14.1 All surfaces of the assembly and mechanism of the fan shall be of corrosion resisting material or shall be suitably and durably protected against corrosion.

5.15 Radio and Television Interference

5.15.1 Radio and television interference suppressors if provided shall be so fitted that they do not adversely affect the safety of the appliance.

5.16 Silent Operation

5.16.1 Precautions shall be taken in the manufacture of fans and regulators to ensure a reasonable degree of silence at all speeds.

NOTE — The need for specifying limits of noise levels (acoustical) of the fans is recognized. However, it has not been found possible to specify these limits at present on account of:

a) dependency of these limits on the actual location of the fans,

b) lack of data on the acceptable noise levels for different applications, and

c) lack of agreed definition of noise level and method of evaluating the same.

The criterion of noise level may, therefore, be subject to an agreement between the manufacturer and the purchaser.

6. PERFORMANCE REQUIREMENTS

6.1 The input to the hot air fan when measured according **8.4.2** shall not deviate from the rated value by more than ± 10 percent.

6.2 The volume and temperature of hot air at the points defined in Appendix A shall be measured and the average value shall not deviate from the declared value by more than ±10 percent.

7. MARKING

7.1 Each fan shall be indelibly marked with the following information:

a) Manufacturer's name, trade name of fan (if any) and number;

b) Rated voltage(s) or voltage range;

c) Type of hot air fan, ac or dc;

d) Frequency or frequency range of power supply, if of ac;

e) Input in watts;

f) Size of fan;

g) Rated air volume; and

h) Country of manufacture.

NOTE — Items (a), (g) and (h) may not be marked if specifically desired by the purchaser.

7.2 In the case of a fan provided with an earthing terminal or contact, it shall be indelibly marked with the symbol ⏚

7.3 The manufacturer may be requested to supply the following additional information:

a) Power factor;

b) Mounting instructions for wall-mounting hot air fans;

c) If the temperature-rise of insulation of supply cable exceeds 50°C then instructions for the use of heat resisting cable shall be given;

d) Type of regulator and number of running positions;

e) Class of insulation;

f) Type of bearings;

g) Instructions for lubrication of bearings; and

h) Temperature of the hot air when tested in accordance with **8.4.1**.

NOTE — For appliances incorporating fan motor, with a total input not exceeding 100 watts, the input marking may be that of heating elements.

7.4 Hot air fans may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Mark) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. TESTS

8.1 Categories of Tests

8.1.1 *Type Tests* — The tests specified below shall constitute type tests and shall be carried out on two samples of hot air fan of the same type and rating selected preferably at random from a regular production lot:

a) Hot air out-put (**8.4.1**),

b) Input (**8.4.2**),

c) Temperature-rise (**8.4.3**),

d) Starting of fan motor (**8.4.4**),

e) Earthing connection (**8.4.5**),

f) Leakage current (**8.4.6**),

g) High voltage (**8.4.7**),

h) Insulation resistance (**8.4.8**),

j) Protection against electric shock (**8.4.9**),

k) Moisture resistance (**8.4.10**),

m) Mechanical strength and stability (**8.4.11**),

n) Cord grip (**8.4.12**),

p) Performance of thermostats and thermal cut-outs (**8.4.13**), and

q) Creepage distances and clearances (**8.4.14**).

8.1.1.1 *Criteria for acceptance* — All samples shall successfully pass all the type tests for proving conformity with the requirements of this standard. If any of the samples fails in any of the type tests, the testing authority at its discretion may call for fresh samples not exceeding twice the original number and subject them again to all the tests or to the tests in which failure(s) occurred. No failure shall be permitted in the repeat test(s).

8.1.2 *General Condition of Test*

8.1.2.1 *Limits of error of electrical instruments* — The error in the indicated value of ammeters, voltmeters and wattmeters shall not exceed 0·5 percent of full scale value for instruments used for type tests. For routine and acceptance tests instruments of accuracy class not worse than 2·5 (*see* IS : 1248-1968*) may be used.

8.1.2.2 *Test voltage* — Unles otherwise specified, the voltage at which the tests are conducted shall be as follows:

a) When a rated voltage range is indicated on the nameplate, the test shall be conducted at the mean of the upper and lower limits of the range provided that the upper limit does not exceed the lower limit by more than 10 percent.

   If the upper limit exceeds this value, the test shall be conducted at the voltage corresponding to either the upper limit or the lower limit whichever is more unfavourable to the particular test.

b) Fans designed for both ac and dc shall be tested at the most unfavourable conditions. In the case of dc, the possible influence of polarity on the operation of the switching devices shall be taken into account.

c) If the fan is rated for two or more distinct voltages, the test shall be performed at all these rated voltages.

8.1.2.3 *Thermal conditions*

a) The fans with thermostats, energy regulators, etc, shall be tested under conditions which will prove most exacting to the fan.

b) Fans with interchangeable heating elements shall be tested with those elements which prove most exacting to the fan. Interchangeable heating elements shall be within the manufacturer's specification for the hot air fans.

8.2 Acceptance Tests — The following shall constitute acceptance tests:

a) Input (**8.4.2**),

b) Starting of fan motor (**8.4.4**),

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*Specification for direct acting electrical indicating instruments (*first revision*).

c) Earthing connection (**8.4.5**),

d) Leakage current (**8.4.6**),

e) High voltage (**8.4.7**),

f) Insulation resistance (**8.4.8**),

g) Protection against electric shock (**8.4.9**), and

h) Performance of thermostats and thermal cut-outs (**8.4.13**).

8.2.1 The method of sampling shall be as agreed to between the supplier and the purchaser. However a recommended method of sampling is given in Appendix B.

8.3 Routine Tests

a) Earthing connection (**8.4.5**),

b) Protection against electric shock (**8.4.9**),

c) Flash test (**8.4.7.5**), and

d) A simple running test to verify that the fan is in working order.

8.4 Schedule of Tests

8.4.1 *Hot Air Output* — This test shall be carried out at an ambient temperature of 27 ± 2°C and relative humidity of 65 ± 5 percent. The test shall be carried out in accordance with the details given in Appendix A.

8.4.2 *Input* — At rated voltage and at normal operating temperature the input shall be measured and it shall conform to **6.1**.

8.4.3 *Temperature-Rise*

8.4.3.1 *General* — Fans normally used on the floor or tables shall be placed on a dull black painted wooden support, away from the walls. Wall-mounting fans shall be mounted on one of the walls as near to the floor or ceiling as they are likely to be mounted in use. Other fans shall be placed in normal position, in a right angle test corner consisting of two dull black painted walls.

The fan shall be connected to the rated voltage or to the most unfavourable voltage within the voltage range.

Temperatures are measured in the case of fans for intermittent operation when maximum values are reached when operated in accordance with manufacturer's instructions and in all other cases when steady temperature is reached.

8.4.3.2 *Measurement of temperature* — The temperature of motor windings shall be measured by resistance method. Temperature rise ($t_2 - t_1$) may be obtained from the ratio of the resistances by the formula:

$$\frac{t_2 + 235}{t_1 + 235} = \frac{R_2}{R_1}$$

where

R_2 = resistance of the winding at temperature t_2 (°C) at the end of the test, and

R_1 = initial resistance of the winding at temperature t_1 (°C) (cold).

From the above, the hot temperature (t_2) may be expressed as:

$$t_2 = \frac{R_2}{R_1} (t_1 + 235) - 235$$

The temperature of other parts, such as handle and grips, shall be measured by thermometer.

8.4.3.3 *Measurement of cooling air temperature* — The temperature of surrounding air shall be measured by at least two thermometers protected against direct blast or hot air from the fan under test or any other hot body in the neighbourhood and kept near the fan under test. For the purpose of this standard, the cooling air temperature shall be considered as the average of readings recorded at ten minutes intervals during the last 30 minutes of the test.

8.4.4 *Starting of Fan Motor* — The fan motor shall be capable of starting from rest at 85 percent of rated voltage or 85 percent of the lowest rated voltage when the rated voltage range is specified.

8.4.5 *Earthing Connection* — The test shall be carried out according to **27.5** of IS : 302-1979*.

8.4.6 *Leakage Current* — The test shall be carried out according to **13.2** of IS : 302-1979*.

8.4.7 *High Voltage Test*

8.4.7.1 The source of supply for high voltage test shall be not less than 500 VA.

8.4.7.2 The high voltage test shall be applied to all new and completed fan motors and regulators in normal working conditions with all parts in place except the capacitors which should be disconnected.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

8.4.7.3 An ac test voltage at a frequency of approximately 50 Hz sine wave-form shall be applied and maintained for one minute without showing any kind of breakdown or flashover.

The test voltage shall be applied as follows:

a) For fan motors:

1) Between live parts and body in the case of motors intended to be earthed — 1 500 volts
2) Between live parts and other inaccessible metal parts (that is, over the functional insulation) in the case of double insulated motors — 1 500 volts
3) Between the inaccessible metal parts and the body (that is, over the supplementary insulation) in the case of double insulated motors — 2 500 volts
4) Between live parts and body (that is, over the reinforced insulation) for reinforced insulated motors — 4 000 volts

b) For regulators:

1) Between any terminal and the body — 1 500 volts
2) Between the terminals with the regulator in the 'off' position — 1 500 volts

8.4.7.4 At the end of one minute, the test voltage shall be removed and the insulation-resistance test conducted as in **8.4.8**.

8.4.7.5 *Flash test* (*routine test*) — Every fan shall withstand the voltage specified in **8.4.7.3** for one second when it is applied instantaneously.

8.4.8 *Insulation Resistance* — The insulation resistance of the fan and its accessories shall be measured with a dc voltage of approximately 500 volts applied between terminals and the body of the fan.

8.4.9 *Protection Against Electric Shock* — The test shall be carried out according to **8** of IS : 302-1979*.

8.4.10 *Moisture Resistance* — The test shall be carried out according to **15.4** and **16** of IS : 302-1979*.

8.4.11 *Mechanical Strength and Stability*

8.4.11.1 *Drop test* — The fan shall be allowed to fall in its normal position of use, 50 times on a concrete floor, from a height of 50 mm.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

After the test, the fan shall show no damage, especially no live parts shall have been made accessible and handles, levers, etc, shall not have moved on their shafts. Damage to paints, small dents or cracks, which do not influence creepage distances or clearances or do not expose live parts, shall be neglected.

A typical test apparatus is shown in Fig. 1.

8.4.11.2 *Vibration test* — The fan shall be subjected to a vibration test having an amplitude of vibration of 0·1 mm at a frequency of 50 Hz. The duration of the test shall be 30 minutes.

After the test, the fan shall show no damage in particular no live parts shall have been made accessible and handles, levers, etc, shall not have moved on their shafts.

8.4.11.3 *Impact test* — The fan shall be placed on a horizontal plane and subjected to blows from a suitable impact test apparatus. A typical apparatus is described in Appendix F of IS : 302-1979*.

Three blows shall be applied to every point liable to damage in use, including handles, levers, and the like.

After the test, the fan shall show no damage, in particular no live parts shall have been made accessible and handles, levers, and the like shall not have moved on their shafts. Damage to paints, small dents, or cracks, which do not influence creepage distances or clearances or do not expose live parts, shall be ignored.

8.4.12 *Cord Grip*

8.4.12.1 The fan shall be fitted with a flexible cord of sizes suitable for the fan, the cord grip being fitted normally. The conductors shall be introduced into the terminals and the screws, if any, shall be tightened to the extent that the conductors are not easily displaced or removed from that position and it is not possible to push the cord further into the fan.

8.4.12.2 The flexible cord or cables shall then be subjected for 25 times to a pull without jerks of 100 N or 5 times the weight of the fan, whichever is less, each pull being applied for one second. Immediately afterwards, the cord or cable shall be subjected, for a period of one minute, to a torque of 0·35 Nm applied nearest to the cord.

8.4.12.3 During the test no damage shall be caused to the flexible cord or cable. At the end of the test, the cord shall not have been displaced by more than 2 mm and the ends of the conductors shall not have moved by

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

more than 1 mm in the terminal longitudinally. In order to enable the displacement to be measured, before starting the test a mark is made on the cord or cable under strain at a distance of approximately 2 cm from the cord grip. At the end of the test, the displacement of this mark in relation to the cord grip is measured while the cord or cable is still under strain.

Terminals shall not break away or be impaired.

8.4.13 *Performance of Thermostats and Thermal Cut-Outs*

8.4.13.0 These tests shall be made on the fan or separately on the thermostats or thermal cut-outs as is most convenient.

8.4.13.1 *Test for thermostat*

i) *Test for making and breaking capacity* — The thermostats shall be laded as follows for making and breaking capacity tests:

   a) Thermostats designed for both ac and dc shall be tested on dc and loaded with 1·25 times the rated current at rated voltage, in a substantially non-inductive circuit; and

   b) Thermostats designed for only ac shall be tested on ac and loaded with 1·25 times the rated current at 1·1 times the rated voltage with a load power factor of unity.

The thermostat shall be made to operate thermally 200 times (200 makes and 200 breaks) at a rate in accordance with the normal switching frequency inheret to the fan. In case the thermostat is being tested separately, the switching frequency may be increased so far as it does not involve additional risk of failure of the thermostat.

Observation — During the test, the thermostat shall operate satisfactorily and no sustained arcing shall occur.

ii) *Endurance test* — The themostat shall be loaded with its rated current at its rated voltage and shall be made to operate thermally 10 000 times (10 000 makes and 10 000 breaks), the other conditions being the same as those specified for breaking and making test [*see* **8.4.13.1**(i)].

Observations

a) After this test, electrical connections shall not have worked loose,

b) Thermostat shall withstand a high voltage test (*see* **8.4.7**), and

c) The insulation between the contact shall withstand a voltage test with twice the rated voltage of the thermostat applied for one minute immediately after the contacts are opened.

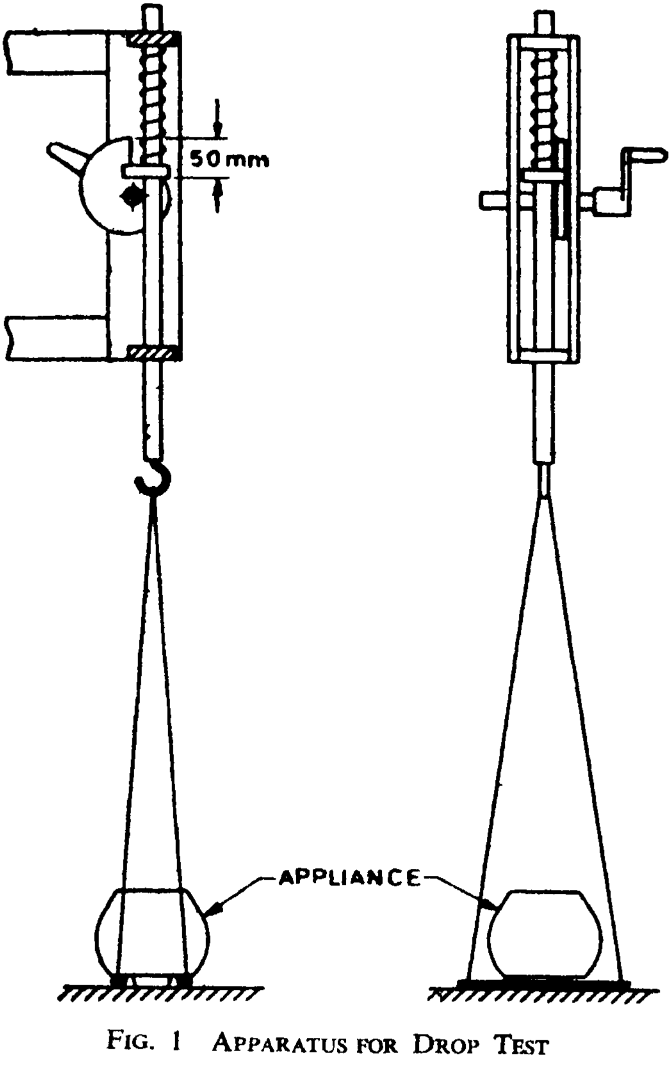

FIG. 1 APPARATUS FOR DROP TEST

8.4.13.2 *Test for thermal cut-outs* — For self-resetting cut-outs, the test shall be made in accordance with **8.4.13.1**(i).

8.4.14 *Creepage Distances and Clearances* — The test shall be carried out according to **29** of IS : 302-1979*.

APPENDIX A

(*Clauses* 6.2 *and* 8.4.1)

TEST METHOD FOR HOT AIR OUTPUT

A-1. An airway (duct) of rectangular cross section having size X and Y equal to not less than 1·5 times the opening of the hot air fan and length 1¼ X is attached to the air output side of the fan. To the outlet end of this airway is attached a mouthpiece of length ¾ X having an included angle of 20°C converging towards the fan (*see* Fig. 2).

A-2. For the purpose of measurement, the airway is considered to be divided into a number of equal square areas by lines parallel to its sides. The number of areas is determined by the ratio of the sides of duct, each square area being approximately equal to half the width (*see* Fig. 3).

A-3. The hot air fan is connected to the supply at the rated voltage. The air velocity is determined by readings of a vane anemometer taken across a plane measurement at a distance X from the outlet of the fan. The anemometer is placed successively at the centre of each square area defined in **A-2,** being supported by wires or other means giving negligible obstruction to the airflow across the section.

A-3.1 The measurement of air velocity is taken at each location to each reading occupying an equal interval of time not less than 30 seconds. Each reading is then corrected in accordance with any calibration correction of instrument. The arithmetical mean of the velocities so obtained is taken to be the average velocity of the air flowing in the airway. Care is taken to see that the airflow through the anemometer is in the direction for which the instrument is calibrated.

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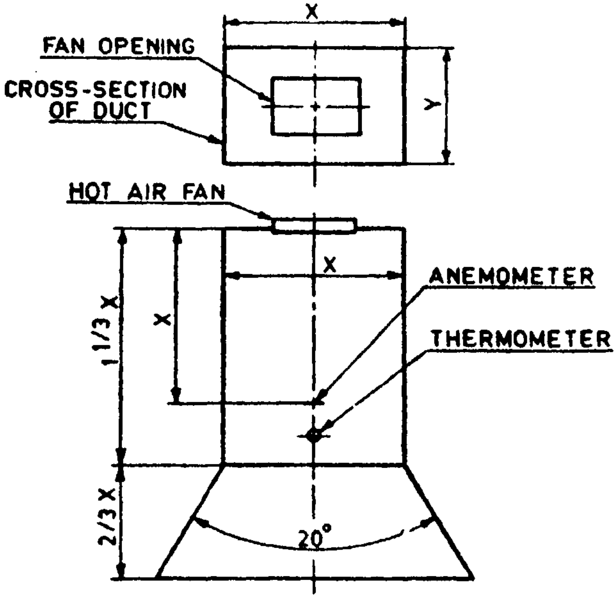

FIG. 2 RECTANGULAR TESTING DUCT FOR HOT AIR FAN

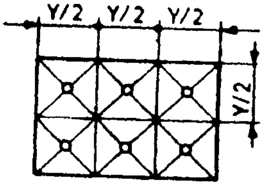

FIG. 3 DIVISION OF AIRWAY SECTION FOR MEASUREMENT PURPOSES

A-3.2 The average velocity so obtained multiplied by the cross-sectional area of the airway at the plane of the measurement is taken to be equal to output air volume.

A-4. A thermometer of suitable range is placed at a distance of 50 mm from anemometer in each position. The average of all the readings is taken as the temperature of the hot air.

APPENDIX B

(*Clause* 8.2.1)

SAMPLING PROCEDURE FOR HOT AIR FANS

B-1. SCALE OF SAMPLING

B-1.1 Lot — All fans of the same type grade category and rating manufactured by the same raw material under similar conditions of production shall be grouped together to constitute a lot.

B-1.2 The number of fans to be selected from each lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 3.

TABLE 3 SAMPLE SIZE AND PERMISSIBLE NUMBER OF DEFECTIVES

LOT SIZE (1)	STAGE (2)	SAMPLE SIZE (3)	CUMULATIVE SAMPLE SIZE (4)	ACCEPTANCE NUMBER (5)	REJECTION NUMBER (6)
Up to 25	First	3	3	0	1
26 ,, 100	First	5	5	0	2
	Second	5	10	1	2
101 ,, 300	First	8	8	0	2
	Second	8	16	1	2
301 and above	First	13	13	0	2
	Second	13	26	1	2

NOTE — For lot size up to 25, decision regarding acceptance or rejection shall be taken at the first stage only.

B-1.2.1 These fans shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS : 4905-1968* may be followed.

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*Methods for random sampling.

B-2. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-2.1 The fans at the first stage, selected at random according to col 1 and 3 of Table 3, shall be subjected to the acceptance tests specified in **8.2.** A fan failing to satisfy any of the acceptance tests, shall be considered as defective. The lot shall be considered as conforming to the requirements if the number of defectives found in the sample is less than or equal to the acceptance number (*see* col 5) and shall be rejected if it is greater than or equal to the rejection number (*see* col 6). For lot of size 26 and larger if the number of defectives lies between the acceptance number and rejection number, the second sample of the same size shall be chosen at random and tested. The number of defectives found in the first and second samples shall be combined and if the combined number of defectives is less than or equal to the corresponding acceptance number of the second sample, the lot shall be accepted; otherwise the lot shall be rejected.

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